

THE ENTOZOA OF MONOTREMATA AND
AUSTRALIAN MARSUPIALIA. No. ii.*

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(From the Bureau of Microbiology, Sydney.)

(Plate iii.)

A number of additional records have been made since the publication of No. i. of this series (Johnston, 1909, *a*, pp. 514-523); and these, together with a few which had been omitted from that paper, are now collected, the parasites being listed under their respective hosts.

1. *MACROPUS GIGANTEUS* Zimm.

1. *Filaria* sp., Bennett (1834, p. 293) refers to his finding long, thin, white filariæ encysted in the knee-joint of the kangaroo, *M. major*. There is little doubt but that the parasite is *Filaria websteri* Cobbold.

2. *Coccidium* (*Eimeria*) sp., Johnston, 1910, *a*, p. 804. This sporozoon was found in abundance in the intestinal epithelium of a specimen belonging to the above-named species, received by Mr. A. S. Le Souëf, Director of the Sydney Zoological Gardens, from the Coonamble district, N.S.W. Coccidia, apparently all belonging to the same species, have now been found in several wallabies (*infra*).

2. *MACROPUS ROBUSTUS* Gould.

Echinococcus granulosus Gmel., more commonly known as *E. polymorphus* Dies., or *E. veterinorum* Rud. I recorded (1909, *b*, p. 79; 1910, *a*, p. 523) my finding the hydatid in a wallaroo, caught in the western district of New South Wales. This larval parasite is now known to infest at least

* Continued from these Proceedings, 1909, xxxiv., p. 523.

five species of *Macropus*, viz., *M. giganteus*, *M. robustus*, *M. thetidis*, *M. dorsalis* and *M. ualabatus*.

3. MACROPUS PARRYI Bennett.

Coccidium (*Eimeria*) sp., was found (Johnston, 1910, *a*, p 433) in the intestinal mucosa of several of these wallabies, sent from South-eastern Queensland to the Sydney Zoological Gardens. The organism appears to be pathogenic to various macropods, and has now been recorded from *M. giganteus*, *M. parryi*, and *M. thetidis*.

4. MACROPUS THETIDIS Less.

1. *Echinococcus granulosus* Gmel. Hydatids were found, *post mortem* (Johnston 1909, *b*, p. 79; 1910, *a*, p. 523) in the lungs of some wallabies of this species which were collected by Mr. H. Burrell, in the New England district, N.S.W., and sent to the Sydney Zoological Gardens.

2. *Coccidium* (*Eimeria*) sp., Johnston, 1910, *a*, p. 523, from the intestinal mucosa (New England, N.S.W.).

5. MACROPUS UALABATUS Less. and Garn.

1. *Echinococcus granulosus* Gmel. Hydatids were recognised (Johnston, 1909, *c*, p. xxix.) in the lungs of a black wallaby, the specimen being collected in the Gosford district, N.S.W., by Mr. L. Gallard.

2. *Bancroftiella tenuis*, Johnston. This cestode was taken from the intestine of this host in Victoria, by Mr. A. S. Le Souëf; a description will be found below.

6. MACROPUS RUFICOLLIS Desm.

Distomum (*Fasciola*) *hepaticum* Abildg. The presence of the liver-fluke of sheep and cattle in the bile-ducts of the red-necked wallaby, is now recorded for the first time. The only other marsupial from which it is specifically recorded is *M. giganteus*, though Cobb (1904, p. 659) mentioned that he had found the parasite in wallabies, but without designating the species of the host. My specimens were collected, for me,

by Mr. Herbert Randell, who obtained them in the Yetholme district, near Bathurst, N.S.W.

7. PETROGALE PENICILLATA Gray.

Sarcozystis mucosa (Blanchard), from the subintestinal connective tissue, is mentioned by Minchin (1903, p. 351), but I have not been able to find Blanchard's original account.

8. ONYCHOGALE FRENATA Gould.

Filaria sp. (Johnston, 1910, *b*, p. xii.). This nematode occurs in small nodules in the subcutaneous tissues of the bridled wallaby, and was collected in Gippsland, Victoria, by Mr. A. S. Le Souëf.

9. DENDROLAGUS BENNETTIANUS.

Filaria sp. (Johnston, 1910, *b*, p. xii.). This parasite was collected by Mr. Le Souëf, from the subcutaneous tissues of Bennett's tree-kangaroo (Northern Queensland).

10. TRICHOSURUS CANINUS Ogilby.

Filaria sp. (Johnston, 1910, *b*, p. xviii.). Mr. L. Gallard found this entozoon in the short-eared opossum, in the Gosford district.

11. PETAURUS SCIUREUS Shaw.

Hæmogregarina petauri Welsh and Barling, 1908. The account was republished in 1909 (p. 329).

12. PHASCOLOMYS URSINUS Shaw.

Moniezia diaphana Zschokke (1907, p. 261). This cestode was taken from the liver of a wombat, *P. wombat* Péi. If the specific name of the host be correct then the locality would be Tasmania, or the neighbouring islands of Bass Strait, as this species is confined to that region. The differences between it and *P. mitchelli* Owen, the form found on the Australian mainland, are very slight.*

* Lyddeker, Handbook to the Marsupialia and Monotremata, 1894, p. 126 (Allen's Naturalist's Library).

13. PERAMELES NASUTA Géoffr.

1. *Hæmogregarina peramelis* Welsh and Dalyell (1909, p. 112). This hæmatozoon was described from material collected in New South Wales.

2. *Gigantorhynchus* sp., Johnston, 1910, *b*, p. xviii. This specimen was collected near Gosford, N.S.W., by Mr. L. Gallard, and appears to be identical with *G. Semoni* Linst.

3. *Linstowia semoni* Zsch. Linstow (1903, p. 2872) recorded the presence of *Tænia* (?) *semoni* Zsch., in a long-nosed bandicoot which had died in the Zoological Gardens, St. Petersburg.

14. PERAMELES OBESULA Shaw.

Echinonema cinctus Linstow (1898, *a*, p. 469). This nematode was described as the type of a new genus, *Hoplocephalus*, but as the name was already preoccupied, he substituted (1898, *b*, p. 627) a new name, *Echinonema*, for it.

15. DASYURUS VIVERRINUS Shaw.

Hæmogregarina dasyuri Welsh, Dalyell and Burfitt (1908). The description was republished in 1909 (1909, p. 333).

16. PHASCOLOGALE PENICILLATA Shaw.

Gigantorhynchus sp. (Johnston, 1910, *b*, p. xviii). This echinorhynch was taken from the intestine of the "brush-tailed rat." It is possible that the host may be *Bettongia penicillata* Gray (New South Wales).

BANCROFTIELLA TENUIS,

A Cestode from the Black Wallaby,
Macropus ualabatus Less. & Garn.

I am indebted to Mr. A. S. Le Souëf for mounted preparations of a tapeworm, taken by him from the intestine of the common wallaby, *Macropus ualabatus* Less. & Garn., in Victoria. The specimens are fragmental, a scolex being present on one slide. The exact length of the parasite is not

known, but appears to be about seven centimètres, the greatest width (which is at the end) being 1.62 mm.

The scolex is very small, its maximum breadth only reaching 0.210 mm. The anterior end is a truncate cone, the summit of which bears a retractile rostellum, whose full length is about 0.11 mm., and its breadth 0.25 mm., the free extremity being expanded into a low cone of 0.065 mm. broad, bearing a double series of hooks. In Fig. 1, the organ is seen to be partly retracted into its muscular sac. There are about sixteen hooks, their length reaching about 0.028 mm. The dorsal root is long and narrow, the ventral root being short, and the claw long, thin, and well curved (Fig. 8).

Situated on the broadest part of the scolex are the four suckers, whose diameter is 0.080 mm., the openings being laterally and slightly anteriorly. Behind these organs, the head gradually narrows into the unsegmented neck-region, which extends for a distance of 0.56 mm., behind the suckers. The narrowest portion is only 0.105 mm., and is just at the point of the commencement of segmentation.

The strobila consists of very numerous proglottids, whose size and form vary considerably in different parts of the chain. Just behind the neck, their length is 0.032 mm., and the breadth 0.130 mm., the ratio being 1:4. The posterior margins scarcely project in this portion (Fig. 1). Further back the form becomes considerably altered, the length being 0.16 mm., the breadth at the anterior end of the segments 0.08, and at the posterior margin 0.13 mm., the ratio now being nearly 4:3. The margin of the strobila is here strongly serrate, and the segments scarcely overlap (Fig. 2). More posteriorly the form is again altered, the proglottids now becoming more quadrate and relatively shorter, and the hinder margin less projecting, the ratio of length (0.081 mm.) to breadth (0.178 mm.) being under 1:2. The lateral margins are here convex (Fig. 3). Beyond this, the segments become much wider (0.534 mm), and overlap to a very considerable degree, more than one-third of each being over-

lapped by the proglottis immediately anterior to it. The posterior third of each segment (*i.e.*, the overlapping portion) in this region is very thin. The ratio of length (0.178 mm.) to breadth is 1:3 (Fig.4). This is followed by a region in which there is an increase in size, and in the degree of development of the segments, all the genitalia being present, though small and not yet functional. The edge presents a serrated appearance, as the margins project considerably. The amount of overlap is small, amounting to about one-fifth of the length. The ratio of length (0.32 mm.) to breadth (0.84 mm.) is about 2:5 (Fig.5). Segments which have reached sexual maturity, have almost the same form (Fig.6), except that they are slightly longer, reaching 0.42 mm., and are much less overlapped by the preceding proglottis. Ripe segments have about the same length as the last-mentioned, but are much broader, being 1.62 mm. in width, the ratio thus being 1:4. Similar variations in the entire strobila were seen in fragments of another specimen belonging to the same species.

Having only microscopic preparations available, no sections were made, and consequently details regarding the body-wall, musculature, etc., cannot be given. Throughout the greater part of the cortex of the strobila, there are numerous large, calcareous bodies of an elliptical form, measuring about 0.012 by 0.0075 mm. They are less abundant in the anterior portion of the worm.

The nervous system could not be followed with any certainty. There seem to be three nerves on each side, a main strand and two accessory nerves, the former apparently lying dorsally to the genital canals.

The excretory vessels lie at some distance inwards from the lateral margins of the segments, their course being fairly straight. The ventral pair are large, the lumen of each being about 0.043 mm., the dorsal trunks being very much narrower, their diameter reaching only 0.010 mm. The

latter lie just above, and very slightly medianwards from, the ventral vessels. In the region of the genital ducts, the vessels become displaced, the dorsal stem becoming pushed dorsally, and the ventral vessel ventrally, the sex-canals passing between them. At the extreme posterior edge of each segment, the ventral vessels become connected by a narrow transverse vessel. In the scolex and neck-region all four trunks are of the same size. At about the level of the middle of the suckers, the pair of vessels on each side form a loop (Fig.1). No connection between the loops on opposite sides could be detected in the specimen.

Genitalia.—The genital papilla is located laterally, in an irregularly alternating manner, near the anterior margin of each segment. It is usually not very prominent. The genital pore is a rather large circular opening, which leads into a spacious genital cloaca, whose wall contains a relatively large amount of radiating and circular muscular fibres, the latter evidently acting as a sphincter. This common genital chamber may extend inwards for a distance of 0.10 mm., its greatest width reaching 0.05 mm. Its usual form may be seen in Fig.9. At times the whole organ may be much more elongate and distinctly tubular, probably as a result of the action of the muscles in its walls (Fig.10). The length then may reach 0.117 mm. but the lumen becomes very narrow, being only 0.007 mm. Opening into the inner end of the cloaca, one may readily recognise the male and female apertures, the former lying immediately in front of the latter, both being placed at about the same dorso-ventral level. Occasionally the female pore is slightly more dorsally situated. The male opening faces postero-laterally, and the female antero-laterally, the two thus lying very close, and in such a position as would suggest the probability of self-impregnation in each segment, an event which was seen frequently in the mature parts of the chain (Fig.10). Both pores not infrequently lie just between the excretory vessels, though their usual position is just laterally to them.

The testes occupy two fields, an anterior and a posterior, separated by the female glands. The anterior field consists of from fourteen to seventeen vesicles lying between the cirrus-sac, vas deferens, female glands, and the dorsal vessel. The posterior field consists of about the same number of glands, these occupying the whole of the dorsal portion of the medulla lying between the female glands and the transverse excretory vessel, and between the longitudinal excretory vessels in the transverse plane. There are thus about thirty-two vesicles altogether. They are rounded or slightly elliptical, having a diameter of from 0.038 to 0.05 mm.; and are disposed in two rows in the dorsal region of the medulla. Lying in the angle formed by the vagina and the cirrus-sac, is the vas deferens, a closely coiled structure. From it there passes, forwards and inwards, an uncoiled portion which enters the cirrus-sac in the extreme anterior part of the proglottis.

The cirrus-sac is a very long tubular organ, lying in the anterior corner of the segment, and extending from near the middle of the anterior margin to the genital cloaca. It frequently exhibits a few loose open coils, thus resembling part of a cork-screw. Its total length is about 0.16 mm., and the breadth 0.034 mm. The musculature is well developed. From its inner end, retractor fibres pass off laterally and slightly ventrally. Within the sac, one may see the coiled male duct ending at the male pore. No distinct external vesicula seminalis was seen. In most of the segments the cirrus was partly everted, and lying in the genital cloaca. The total length of the eversible portion exceeds 0.10 mm. The organ is rather wider at its base than at its extremity. Its surface appears to be devoid of armature. In no case was the cirrus seen projecting much beyond the genital pore, but as the cirrus-sac still possessed its corkscrew-like form, it is quite likely that the fully everted organ may project some little distance through the pore. In one of the segments, self-fertilisation was observed (Fig.10), the cirrus being bent

round to enter directly into the vagina, the edge of the male organ reaching a swollen rounded part, which evidently was functional as an outer receptaculum seminis.

As already mentioned, the female pore lies immediately behind, and at about the same dorso-ventral level, as the male aperture. From it there passes inwards, the wide vagina, which almost immediately becomes thrown into a number of irregular coils. In this portion of the duct, one pore is frequently more swollen and rounded than the rest, and, being filled with spermatozoa, evidently acts as an external receptaculum seminis. This latter may be seen persisting even in ripe segments. After passing inwards between the excretory vessels, it commences to arch posteriorly, just behind the coiled portion of the vas deferens, which it crosses dorsally, here widening into an elongate, thin-walled receptaculum seminis. The latter passes into a very short, narrow fertilising duct, which passes through the shell-gland.

The female complex lies just behind the middle of the segment. It has already been stated that it separates the male organ into a posterior and an anterior field. The ovary is a transversely elongate organ, 0.24 mm. in breadth, very distinctly bilobed, each lobe being made up of a number of short tubes. The ovarian bridge lies ventrally below the receptaculum. The short oviduct passes backwards to meet the fertilising canal. The vitellarium lies in the bay between, and behind, the ovarian lobes, as a rather solid organ, 0.075 mm. in breadth, whose margins are lobed. From it, there passes forwards a very short yolk-duct, to the shell-gland, which lies just antero-dorsally to it.

The uterus at first develops in the region of the ovary, but soon begins to increase in size by the development of processes, the other organs in the segment becoming displaced. In the ripest proglottids present in the specimens, the uterus may be seen as a large, ventrally situated, transverse sac with strongly sacculated walls. The whole of the midregion of the segment, with the exception of the extreme

anterior portion, becomes filled by it, as it soon comes to extend from the excretory vessels of the one side to those of the other. Some of the processes from the walls penetrate deeply into the cavity, so that the whole organ appears to be made up of a large number of chambers opening into the main, transversely lying portion. In such segments, the male and female ducts still persist, though they are pushed far forwards; the testes, though present, are partly atrophied; whilst, of the female glands, the vitellarium, which lies near the middle of the posterior margin of the proglottid, is the only part recognisable. Ripe eggs were not present, but immature eggs measured 0.011 mm. in diameter, the embryo being 0.006 by 0.004 mm.

Systematic Position.—This parasite of the black wallaby is of considerable interest, as it is the first, armed, adult cestode to be described from a marsupial. All the tapeworms so far known from the Aplacentalia of Australia and the East Indies, belong to the *Anoplocephalinae*, a fact already emphasised by Zschokke (1899). The parasite under review approaches very nearly to the genera *Choanotenia*, *Monopylidium* and *Anomotenia*, but possesses characters which seem to me to be of sufficient importance to justify the erection of a new genus, *Bancroftiella*, for its reception, the generic name being given in honour of Drs. J. and T. L. Bancroft, of Queensland, who were the pioneers of Australian parasitology. The following may serve as a generic diagnosis:—

Dipylidiinae (of Stiles = Dilepinae of Fuhrmann): rostellum armed with two rows of hooks; genital pores irregularly alternating; genital ducts passing between the excretory canals; testes numerous, arranged in two fields, an anterior and a posterior, separated by the female complex; uterus saclike with numerous septa projecting into and dividing up the cavity.

Type-species *Bancroftiella tenuis*, n.sp., from *Macropus ulabatus*, the type-specimen being deposited in the Australian Museum, Sydney. This genus differs from the three

genera mentioned above, in the disposition of the testes; and from the last two, in the character of the uterus. *Choanotenia* has a single circlet of hooks on the rostellum.

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EXPLANATION OF PLATE III.

Bancroftiella tenuis, n. sp.

Fig. 1.—Anterior end of the strobila.

Figs. 2-7.—Successive portions of the strobila.

Fig. 5.—Segments showing immature genitalia.

Fig. 6.—Segments showing mature genitalia.

Fig. 7.—Segments showing uterus.

(All the above are drawn to the same scale).

Fig. 8.—Hook from scolex.

Fig. 9.—Cloaca showing genital apertures, etc.

Fig. 10.—Cloaca, etc., showing self-impregnation.

Reference letters.

c., cirrus—*c.s.*, cirrus-sac—*c.s.r.*, cirrus-sac retractor—*d.e.v.*, dorsal excretory vessel—*g.c.*, genital cloaca—*g.e.*, genital papilla—*n.*, nerve—*ov.*, ovary—*r.s.*, receptaculum seminis—*t.*, testes—*tr.v.*, transverse excretory vessel—*u.*, uterus—*v.*, vagina—*v.d.*, vas deferens—*v.g.*, vitelline gland—*v.e.v.*, ventral excretory vessel.

